Scientific and Technical Information (STI)

STI BULLETIN ONLINE

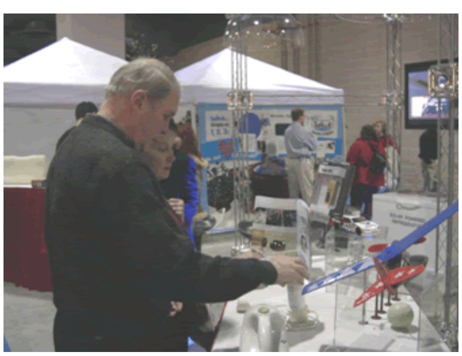
A quarterly publication of the NASA Scientific and Technical Information (STI) Program produced by the NASA Center for AeroSpace Information (CASI) for the users of our information products and services.

April 2004

Featured Article

NASA Brings it Home

Visitors at the Philadelphia Home Show examine sample products of NASA technology transfer featured in NASA's Spinoff magazine. Spinoff editors Michelle Birdsall and Jamie Janvier of the NASA Center for AeroSpace Information (CASI) were there to demonstrate products and explain the technology that enabled their development.



When most people pick up a Dustbuster or cordless power tool, they don't realize that the technology was first developed to help astronauts drill and collect soil samples on the Moon. In January, Marshall Space Flight Center sponsored an exhibit at the Philadelphia Home Show, giving the public an inside look at various household items such as these that have originated from NASA technology.

While many curious onlookers examined the products on display at the NASA booth, the home show provided a unique opportunity for Michelle Birdsall and Jamie Janvier, editors of NASA's Spinoff magazine, to share their technology transfer knowledge. In a televised news segment, Comcast CN8 News reporter Nicole Fox interviewed the two Spinoff editors, inviting them to explain NASA's unique connection to the shoes, pillow, golf club, and sunglasses on display.

Using the sunglasses as an example, Janvier explained that the lenses are based on a NASA process for achieving diamond-hard coatings for aerospace systems. They offer true scratch resistance and readily shed water, reducing smudges and spotting. The lightweight titanium and alloy frames, which ease pressure points and are devoid of hinge screws that could dislodge, were originally developed for spacewalks.

In addition to sharing the unique background of these everyday items, the news segment offered the public a chance to learn more by introducing them to *Spinoff*, which features between 40 to 50 products resulting from NASA technology each year. From solar refrigerators to warmer ski jackets, *Spinoff* highlights NASA technologies that benefit the U.S. economy and improve our quality of life. To learn more about NASA spinoffs and to obtain a complimentary copy of the latest *Spinoff* issue, please visit *Spinoff* online at www.sti.nasa.gov/tto/, or contact Michelle Birdsall (301-621-0244 / mbirdsall@sti.nasa.gov) or Jamie Janvier (301-621-0242 / jjanvier@sti.nasa.gov).

Do you know that...

...monitoring systems used in intensive care units and heart rehabilitation wards were developed from the systems used to monitor astronauts during the first space missions in the early 1960s?

...Lifeshears, a powerful hand-held rescue tool, relies on the same power source used to separate solid rocket boosters from Space Shuttles?

... Breast biopsies that can be performed with a needle instead of a scalpel are the result of digital-imaging technology developed by the Hubble Space Telescope Program?

... new lighting technology originally developed by NASA for plant growth experiments in space is improving the treatment of brain and skin tumors and enhancing wound healing?

... a meteorological detection and monitoring system developed to improve the safety at Kennedy Space Center's launch pads also aids firefighters by providing real-time fire threat data?

... a video enhancement system invented by NASA scientists to clarify and stabilize dark, jittery images has become an invaluable law enforcement tool?

...NASA rocket engine know-how contributed to a lifesaving heart pump that keeps critically ill patients alive until a donor heart is available?

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Focus On ... Space Radiation

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The NASA Space Radiation Laboratory (NSRL) is one of the few places that can simulate the harsh cosmic and solar radiation environment found in space. The facility employs beams of heavy ions extracted from the Brookhaven National Laboratory's Booster accelerator. Here, NSRL researcher Debasish Roy places a sample into the NSRL beam line.

Manned space exploration in the 21st century holds exciting prospects for the advancement of science and the expansion of the human experience. Plans include the Alpha space station, an outpost on the Moon, exploration of near asteroids, and a piloted mission to Mars. However, human crew members must be protected against the harsh environment of space. Of all the environmental challenges that need to be overcome, ionizing radiation is at the top of the list. Many consider radiation to be the “spoiler” of extended space travel not only for its effects on humans, but also for its effects on the materiel that will enable such exploration.

The following sections provide a sample of recently published space radiation material found in the NASA Technical Report Server (NTRS). The listing is limited to recently published, publicly available information. Some documents are available in full-text Portable Document Format (PDF) that you can download, while others can be purchased through the STI Help Desk at 301-621-0390 or help@sti.nasa.gov. Please use the document identification numbers listed below when purchasing documents.

Effects on Humans

Anderson, Brooke M.; Nealy, John E.; Kim, Myung-Hee; Qualls, Garry D.; Wilson, John W. Analysis of a Radiation Model of the Shuttle Space Suit. 20030033907.

Miller, Jack; Heilbronn, Lawrence H.; Zeitlin, Cary J.; Wilson, John W.; Singleterry, Robert C., Jr.; Thibeault, Sheila Ann. Radiation Transport Properties of Potential In Situ-Developed Regolith-Epoxy Materials for Martian Habitats. 20030060559.

Zeitlin, Cary J.; Heilbronn, Lawrence H.; Miller, Jack; Wilson, John W.; Singleterry, Robert C., Jr.; Title (Incl. Subtitle): Measurement of Charged Particle Interactions in Spacecraft and Planetary Habitat Shielding Materials. 20030060588.

Effects on Material

Blattnig, Steve R.; Norbury, John W.; Norman, Ryan B. Radiation Shielding for Space Flight. 20040000799.

Hambourger, Paul D. Physical Properties and Durability of New Materials for Space and Commercial Applications. 20030055667.

Miller, Jack; Heilbronn, Lawrence H.; Zeitlin, Cary J.; Wilson, John W.; Singleterry, Robert C., Jr.; Thibeault, Sheila Ann. Radiation Transport Properties of Potential In Situ-Developed Regolith-Epoxy Materials for Martian Habitats. 20030060559.

Oldham, Timothy R.; McLean, F. B. Total Ionizing Dose Effects in MOS Oxides and Devices. 20030032300.

Pinsky, Lawrence; Wilson, Thomas; Empl, Anton; Andersen, Victor. Monte Carlo Methods in Materials Science Based on FLUKA and ROOT. 20030060561.

Zeitlin, Cary J.; Heilbronn, Lawrence H.; Miller, Jack; Wilson, John W.; Singleterry, Robert C., Jr. Measurement of Charged Particle Interactions in Spacecraft and Planetary Habitat Shielding Materials. 20030060588.

Radiation Environments

Barth, Janet L. Space and Atmospheric Environments: From Low Earth Orbits to Deep Space. 20030053331.

Plaut, J. J. Mars Odyssey Science: The First Year and Beyond. 20030110814.

Zeitlin, C.; Cleghorn, T.; Cucinotta, F.; Saganti, P.; Andersen, V.; Lee, K.; Pinsky, L.; Atwell, W.; Turner, R. Results from the Martian Radiation Environment Experiment MARIE. 20030111588.

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From NASA Headquarters

OBPR's Radiation Research Program

Mary Kicza, Associate Administrator, NASA Office of Biological and Physical Research (OBPR) and Walter Schimmerling, NASA's OBPR Radiation Health Program Manager at the dedication of the NASA Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory.

What does NASA's OBPR Space Radiation Research Program have to do with STI? A lot, as you can see from the Focus On ... Space Radiation and Publication News sections of this issue. And — as NASA implements the directives in the President's Space Initiative — even more in the coming years through the publications that are generated by studies of man and materiel pushing the envelope of extended space travel. So, here is a little background on space radiation and the NASA Space Radiation Research Program from OBPR's perspective.

Humans engaged in space activities are exposed to extraterrestrial radiation, consisting of protons and heavier charged particles. Doses and dose rates typical of those caused by solar disturbances may impair crew performance whereas doses and dose rates typical of the galactic cosmic ray environment are likely to result in longer term effects, most notably an increase in the probability of cancer induction. The goal of NASA's OBPR Space Radiation Research Program (http://spaceresearch.nasa.gov/research_projects/radiation.html) is to develop the scientific basis for the protection of human crew members from space radiation. The research will guide the design of spacecraft and planetary habitats for long-term human space exploration.

The program encompasses research in physics, chemistry, materials science, biology, and medicine. It supports scientific research in three areas: 1) the fundamental mechanisms of radiation effects on living systems and the interaction of radiation with cells, tissues, and organs; 2) the development of instruments and processes dealing with the measurement of radiation and its effects; and 3) the development of models to predict and describe the physics of the interactions of high energy charged particles and matter. Furthermore, the development and implementation of radiation protection standards raises social and legal issues; NASA policy requires this program to adhere to the highest ethical and moral standards.

The ground-based component of the program develops scientific bases for the prediction of risk, which can be tested in limited ways in ground-based facilities. The space-based component of the program, however, will use flight opportunities to validate models of the space environment and transport of radiation. This is accomplished through shielding, assessment of the efficacy of ground-based experiments for predicting risk, testing of countermeasures, and understanding the synergism between the effects of radiation and other space flight factors such as weightlessness.

The findings will be applied, wherever possible, to the improvement of life and occupational health on Earth. Such benefits may take the form of better protection against the effects of radiation exposure, more precise radiation detection capabilities, and improved knowledge about the causes and mechanisms of cancer, the function of the central nervous system, and other critical tissues, aging, and plant breeding.

The OBPR Space Radiation Research Program funds research at NASA Centers, universities, Department of Energy National Laboratories, and other Federal agencies. NASA researchers also work closely with scientists from other space faring nations.

From the Users

This department is for you! We welcome your contributions and comments. Send them to us, and we will consider them for publication in the next issue.

NASA Videos Q & A

Q. I am working for the science and technology magazine called Popularis, broadcast by the national Czech TV. We would like to present stories on the latest research of our solar system, our planets and on the search for exoplanets. Do you have any footage on these topics, please?

A. You can conduct a search yourself for videos on two NASA Internet sites. You can use the NASA Video Catalog, a searchable PDF at http://www.sti.nasa.gov (bottom link in the center, **NASA Videos**). If you prefer using a database, you can use the NTRS: NASA Technical Reports Server located at http://ntrs.nasa.gov. Type “video” in the search box and add other keywords that are relevant to your search. For example, “video solar system” will produce abstracts of videos that are relevant to the solar system.

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From the STI Program Office

Release of NIX2

The STI Program Office will soon release a new version of the NASA Image eXchange (NIX), called NIX2. This new version of NIX centralizes the metadata by using XML and Lucene to correct a number of problems associated with the fully distributed model used in the previous version of NIX. Issues concerning the deployment of geographically distributed mirror servers are being resolved to ensure consistent reliability. For more information, you may contact Bill von Ofenheim at w.h.c.vonofenheim@larc.nasa.gov.

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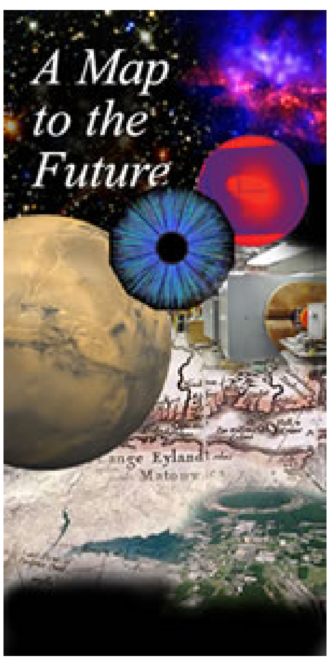
Current Topics

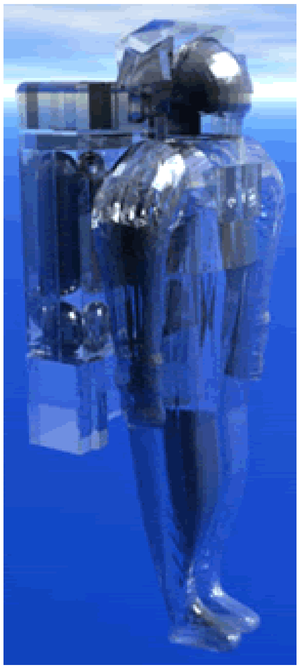
Space Radiation Workshop Proceedings



The 3rd International Workshop on Space Radiation Research and 15th Annual NASA Space Radiation Health Investigators' Workshop will be held on May 16–20, 2004 in Port Jefferson, New York (http://www.dsls.usra.edu/meetings/radiation2004/index.html). Opening session speakers will include Walter Schimmerling, NASA's Office of Biological and Physical Research (OBPR) Space Radiation Health Program Manager; Praveen Chaudhari, Brookhaven National Laboratory Director; and Francis A. Cucinotta, head of the Space Radiation Health Project at NASA's Johnson Space Center. Plenary session topics include Radiation Carcinogenesis and Genomic Instability; Non-Cancer Risks; Neurological Damage from Space Radiation; Molecular and Cellular Responses; Radiation Quality and Biological Studies of Shielding; Dosimetry, Physics, and Shielding; Biomarkers, Sensitivity, and Prevention; and Space Exploration Radiation Risk Assessment Roadmap. Workshop proceedings will be published in a special supplement to Radiation Research (http://www.radres.org/).

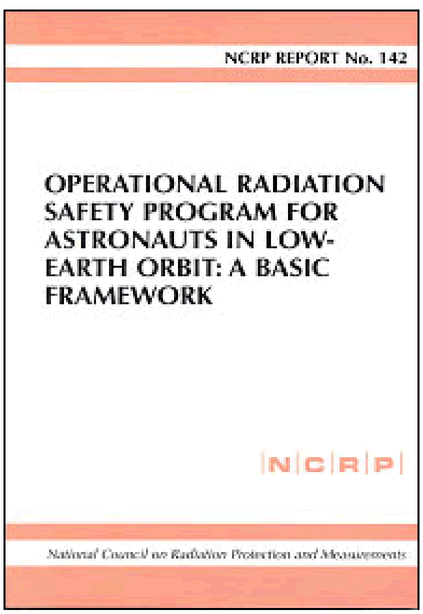
EVA Space Suit Technical Paper

Computerized model of ISS EVA space suit developed by Radiation Shielding Design Team at NASA Langley Research Center.



According to the Space RAD Health Newsletter (http://srhp.jsc.nasa.gov/newsletter/volume3-3/Index.cfm), A NASA Technical Paper, NASA/TP-2003-212051, has been published on the radiation protection tests of Russian and American space suits, the Russian Space Agency (RSA) Orlan space suit and the NASA Extravehicular Mobility Unit (EMU), respectively. Edited by Drs. Francis A. Cucinotta, Mark R. Shavers, Premkumar B. Saganti, and Jack Miller, the technical paper details the space suit testing that involved extensive collaborations between the NASA Johnson Space Center Extravehicular Activity Program Office, NASA Johnson Space Center Space Radiation Health Project Office, Russian Space Agency, Loma Linda University Proton Treatment Center, NASA Langley Research Center, Lawrence Berkeley National Laboratory, and the Brookhaven National Laboratory. Participants in the activity were scientists from the NASA Johnson Space Center, NASA JSC Space Radiation Health Project Office, NASA Langley Research Center, Loma Linda University, Lawrence Berkeley National Laboratory, and ERIL Research Corporation.

NCRP Report on Radiation Safety



According to the Space RAD Health Newsletter, The National Council on Radiation Protection and Measurements (NCRP) released their report on Operational Radiation Safety Program for Astronauts in Low Earth Orbit: A Basic Framework (NCRP-Report No.142, 2002). The committee members for the report were Richard J. Vetter (Mayo Clinic), Chair, Ellen S. Baker (NASA Johnson Space Center), David T. Bartlett (National Radiological Protection Board), Thomas B. Borak (Colorado State University), Susan M. Laghorst (Washington University in St. Louis), Stephen W.S. McKeever (Oklahoma State University), Jack Miller (Lawrence Berkeley National Laboratory), R. Julian Preston (Environmental Protection Agency), and John W. Wilson (NASA Langley Research Center). Charles B. Meinhold (NCRP) served as an advisor to the Committee.

The new report reviews current methods, and makes 20 major recommendations on all areas of operational radiation safety program including:

- Methods of physical and biological dosimetry
- Approaches to immediate dose management
- Implementation of the ALARA principle
- Organ dose assessments and radiation safety records
- The overall management and structure of the radiation protection program

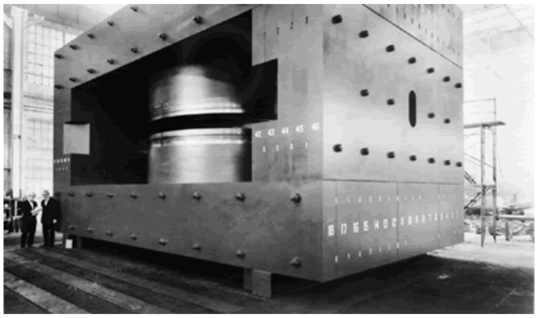
You can obtain a copy at http://www.ncrp.com/pubs.html.

NASA History

Great Radiation Images

GReat Images in NASA (GRIN) is a collection of over a thousand images of significant historical interest scanned at high-resolution in several sizes. The following is a sample of great images in NASA history with radiation research.

Massive Magnetic Core, Langley Research Center, 1 January 1964.



The massive magnetic core of the Space Radiation Effects Laboratory's Synchrocyclotron at NASA's Langley Research Center is a 3000 ton (6 million pound), 36' x 21' x 19.5' assembly of forged steel that serves as the heart of the 600 million electron volt, high energy proton accelerator.

Pioneer III Probe, Jet Propulsion Laboratory

Looking more like surgeons, these technicians wearing "cleanroom" attire inspect the Pioneer III probe before shipping it to Cape Canaveral, Florida. Pioneer III was launched on December 6, 1958 aboard a Juno II rocket at the Atlantic Missile Range, Cape Canaveral, Florida. The mission objectives were to measure the radiation intensity of the Van Allen radiation belt, test long range communication systems, the launch vehicle and other subsystems. The Juno II failed to reach proper orbital escape velocity. The probe re-entered the Earth's atmosphere on December 7th ending its brief mission.

Explorer I Architects, Jet Propulsion Laboratory, 1 January 1958

The three men responsible for the success of Explorer I, America's first Earth satellite which was launched January 31, 1958. At left is Dr. William H. Pickering, former director of JPL, which built and operated the satellite. Dr. James A. van Allen, center, of the State University of Iowa, designed and built the instrument on Explorer that discovered the radiation belts which circle the Earth. At right is Dr. Wernher von Braun, leader of the Army's Redstone Arsenal team which built the first stage Redstone rocket that launched Explorer I.

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